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# मानक

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IS 15704 (2006): Automotive vehicles - Retreaded pneumatic tyres for commercial vehicles [TED 7: Automotive Tyres, Tubes and Rims]



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*Indian Standard*  
AUTOMOTIVE VEHICLES — RETREADED  
PNEUMATIC TYRES FOR COMMERCIAL  
VEHICLES — SPECIFICATION

ICS 83.160.10

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**BUREAU OF INDIAN STANDARDS**  
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NEW DELHI 110002

FOREWORD

This Indian Standard was adopted by the Bureau of Indian Standards, after the draft finalized by the Automotive Tyres, Tubes and Rims Sectional Committee had been approved by the Transport Engineering Division Council.

In the formulation of this standard, assistance has been derived from the following regulation:

ECE 109      Uniform provisions concerning the approval for the production of retreaded pneumatic tyres for commercial vehicles and their trailers

The following Indian Standards may be referred for valve, valve accessories and terminology of automotive vehicles:

| <i>IS No.</i>         | <i>Title</i>                                                                                                    |
|-----------------------|-----------------------------------------------------------------------------------------------------------------|
| 9081 : 2001           | Automotive vehicles —Valves and valve accessories for pneumatic tyres — Specification ( <i>third revision</i> ) |
| 10939 : 2000          | Designation system for tyre tube valves for automotive vehicles ( <i>first revision</i> )                       |
| 14272 (Part 1) : 1995 | Automotive vehicles — Types — Terminology: Part 1 Three and four wheelers                                       |

In this standard SI units have been used, the unit of force, in Newton (N), of tyre load, in kilogram (kg) and of pressure, in Pascal (Pa). Their relationship are given below for information:

$$1 \text{ kgf} = 9.806 \text{ 65 N}$$
$$1 \text{ kgf/cm}^2 = 98.066 \text{ kPa}$$

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS 2 : 1960 ‘Rules for rounding off numerical values (*revised*)’. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

# Indian Standard

## AUTOMOTIVE VEHICLES — RETREADED PNEUMATIC TYRES FOR COMMERCIAL VEHICLES — SPECIFICATION

### 1 SCOPE

This standard prescribes to the production of retreaded tyres intended to be fitted to commercial vehicles and their trailers used on the road. It does not, however, apply to:

- a) Retreaded tyres with a speed capability below 80 km/h.
- b) Tyres for cycles and motorcycles.
- c) Tyres originally produced without speed symbols and/or load indices.

### 2 REFERENCES

The following standards contain provisions, which through reference in this text, constitute provisions of this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below:

| IS No.                | Title                                                                                                        |
|-----------------------|--------------------------------------------------------------------------------------------------------------|
| 10694 (Part 3) : 1991 | Automotive vehicles — Rims — General requirements: Part 3 Commercial vehicles rims ( <i>first revision</i> ) |
| 15636 : 2005          | Automotive vehicles — Pneumatic tyres for commercial vehicles — Diagonal and radial ply — Specification      |

### 3 DEFINITIONS

**3.1** The nomenclature used is given in Fig. 1.

**3.2 Structure** — Structure of pneumatic tyre means the technical characteristics of the tyre's carcass. The following structures are distinguished in particular:

- a) *Diagonal or Bias-ply* — Pneumatic tyre structure in which the ply cords extend to the beads and are laid at alternate angles substantially less than 90° to the centreline of the tread.
- b) *Bias-belted* — Pneumatic tyre structure of diagonal (bias-ply) type in which the carcass is stabilized by

a belt, comprising two or more layers of substantially in extensible cord material laid at alternate angles close to those of the carcass.

- c) *Radial* — Pneumatic tyre structure in which the ply cords extend to the beads and are laid substantially at 90° to the centreline of the tread, the carcass being stabilized by an essentially in-extensible circumferential belt.

### 3.3 Category of Use

**3.3.1 Normal Tyre** — Tyre intended for normal road use only.

**3.3.2 Special Use Tyre** — Tyre intended for mixed use, both on and off road and/or at restricted speed.

**3.3.3 Snow Tyre** — Tyre whose tread pattern, or tread pattern and structure is primarily designed to ensure, in mud and fresh or melting snow, a performance better than that of a normal tyre. The tread pattern of a snow tyre generally consists of groove (rib) and/or solid block elements more widely spaced than on a normal tyre.

**3.4 Bead** — Part of a pneumatic tyre which is of such shape and structure as to fit the rim and hold the tyre on it (*see Fig.1*).

**3.5 Cord** — Strands forming the fabric of the plies in pneumatic tyre.

**3.6 Ply** — A layer of rubber-coated parallel cords.

**3.7 Belt (Radial or Bias-Belted)** — Layer or layers of material or materials underneath the tread, laid substantially in the direction of the centreline of the tread to restrict the carcass in a circumferential direction.

**3.8 Breaker (Diagonal)** — Intermediate rubberised fabric layers/plies between the carcass and the tread, which helps bonding as well as protects the casing from road shocks.

**3.9 Protective Breaker** — Applies to a radial ply tyre and means an optional intermediate ply between the tread and belt to minimize damage to the belt.

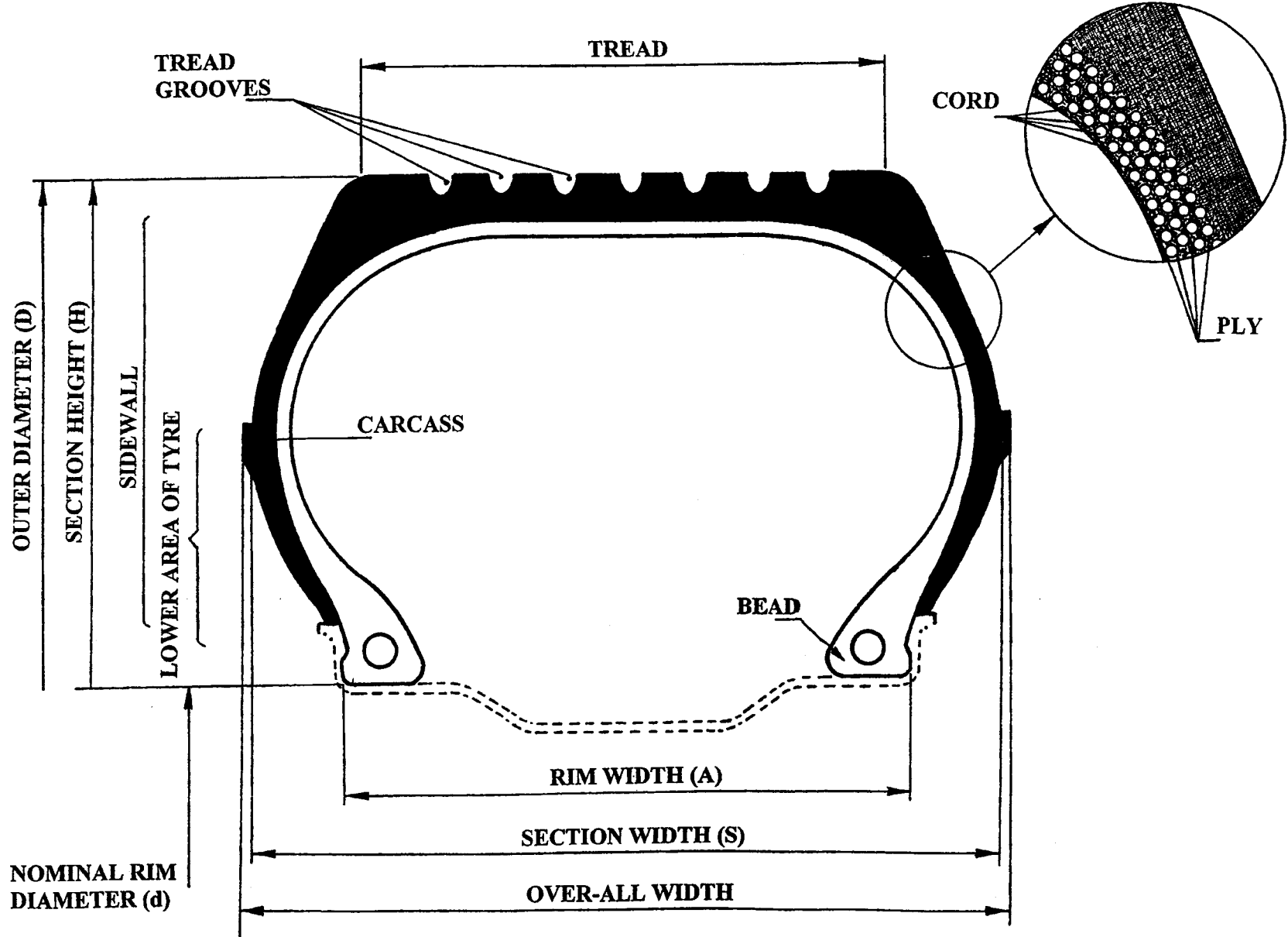


FIG. 1 NOMENCLATURE OF TYRE

**3.10 Chafer** — Material in the bead area to protect the carcass against chafing or abrasion by the wheel rim.

**3.11 Carcass** — Structural part of a pneumatic tyre other than the tread and outermost 'rubber' side walls which, when inflated, supports the load.

**3.12 Tread** — Part of a pneumatic tyre which is designed to come into contact with the ground and through which driving, braking and cornering forces are transmitted. It protects the carcass against mechanical damage and contributes to ground adhesion.

**3.13 Side Wall** — Part of a pneumatic tyre between the tread and the area designed to be covered by the rim flange.

**3.14 Lower Area of Tyre** — Area included between the line of maximum section width of a tyre and area designed to be covered by the edge of rim.

**3.15 Tread Groove** — Space between the adjacent ribs or blocks in the tread pattern (*see* Fig.1).

**3.16 Section Width ( $S$ )** — Linear distance between the outsides of the side walls of an inflated pneumatic tyre, when fitted to the specified measuring rim, and excluding elevations due to labelling (marking), decoration or protective bands or ribs.

**3.17 Overall Width** — Linear distance between the outsides of the sidewalls of an inflated pneumatic tyre, when fitted to the specified measuring rim and including labelling (marking), decoration and protective bands or ribs.

**3.18 Section Height ( $H$ )** — Distance equal to half the difference between the outer diameter of the tyre and the nominal rim diameter.

**3.19 Nominal Aspect Ratio ( $R_n$ )** — Hundred times the number obtained by dividing the number expressing the nominal section height ( $H$ ) by the number expressing the nominal section width ( $S$ ), both dimensions being in the same units.

**3.20 Outer Diameter ( $D$ )** — Overall diameter of an inflated, newly retreaded tyre.

**3.21 Tyre-Size Designation** — A designation showing:

- a) *Nominal section width* — This shall be expressed in millimetres, except in cases of tyres for which the size designation is shown in col 2 of Tables 4 to 12 in IS 15636.
- b) *Nominal aspect ratio* — Except in cases of tyres for which the size designation is shown in col 2 of Tables 4 to 12 in IS 15636.

- c) *A conventional number 'd'* — Denoting the nominal rim diameter of the rim and corresponding to its diameter expressed either by codes (numbers below 100) or in millimetres (numbers above 100). Numbers corresponding to both types of measurements may be used in the designation.

**3.22 Nominal Rim Diameter ( $d$ )** — Diameter of the rim on which a tyre is designed to be mounted.

**3.23 Rim** — Support, either for a tyre-and-tube assembly, or for a tubeless tyre, on which the tyre beads are seated [*see* IS 10694 (Part 3)].

**3.27 Chunking** — Breaking away of pieces of rubber from the tread.

**3.28 Cord Separation** — Parting of the cords from their rubber coating.

**3.29 Ply Separation** — Parting of adjacent plies.

**3.30 Tread Separation** — Pulling away of the tread from the carcass.

**3.31 Service Description** — Specific combination of the load index and speed symbol of the tyre.

**3.32 Load Index** — A numerical code which indicates the load the tyre can carry at the speed corresponding to the associated speed symbol and when operated in conformity with the service conditions specified by the manufacturer. A pneumatic tyre can have more than one load index to indicate its load capacity when used in single or dual formation. The list of load indices and the corresponding loads are given in Table 1.

### 3.33 Speed Symbol

**3.33.1** An alphabetical symbol indicating the speed at which the tyre can carry the load given by the associated load index.

**3.33.2** Speed symbols and corresponding speeds are shown in Table 2.

**3.34 Unique Point** — An additional service description, marked adjacent to the normal service description, but which must not be used for calculating a load capacity variation given in 3.35.

**3.35 Load-Capacity Variation with Speed** — An alternative load capacity for the tyre when used at a speed different from that indicated by the speed symbol in the normal service description. The permissible variations are given in Table 3.

**3.36 Retreading** — Generic term for reconditioning a

**Table 1 Correlation Between Load Index and Corresponding Maximum Load to be Carried**  
(Clause 3.32)

| Load Index | Corresponding Maximum Load to be Carried kg | Load Index | Corresponding Maximum Load to be Carried kg | Load Index | Corresponding Maximum Load to be Carried kg | Load Index | Corresponding Maximum Load to be Carried kg |
|------------|---------------------------------------------|------------|---------------------------------------------|------------|---------------------------------------------|------------|---------------------------------------------|
| (1)        | (2)                                         | (1)        | (2)                                         | (1)        | (2)                                         | (1)        | (2)                                         |
| 60         | 250                                         | 97         | 730                                         | 134        | 2 120                                       | 171        | 6150                                        |
| 61         | 257                                         | 98         | 750                                         | 135        | 2 180                                       | 172        | 6300                                        |
| 62         | 265                                         | 99         | 775                                         | 136        | 2 240                                       | 173        | 6500                                        |
| 63         | 272                                         | 100        | 800                                         | 137        | 2 300                                       | 174        | 6700                                        |
| 64         | 280                                         | 101        | 825                                         | 138        | 2 360                                       | 175        | 6900                                        |
| 65         | 290                                         | 102        | 850                                         | 139        | 2 430                                       | 176        | 7100                                        |
| 66         | 300                                         | 103        | 875                                         | 140        | 2 500                                       | 177        | 7 300                                       |
| 67         | 307                                         | 104        | 900                                         | 141        | 2 575                                       | 178        | 7 500                                       |
| 68         | 315                                         | 105        | 925                                         | 142        | 2 650                                       | 179        | 7 750                                       |
| 69         | 325                                         | 106        | 950                                         | 143        | 2 725                                       | 180        | 8 000                                       |
| 70         | 335                                         | 107        | 975                                         | 144        | 2 800                                       | 181        | 8 250                                       |
| 71         | 345                                         | 108        | 1 000                                       | 145        | 2 900                                       | 182        | 8 500                                       |
| 72         | 355                                         | 109        | 1 030                                       | 146        | 3 000                                       | 183        | 8 750                                       |
| 73         | 365                                         | 110        | 1 060                                       | 147        | 3 075                                       | 184        | 9 000                                       |
| 74         | 375                                         | 111        | 1 090                                       | 148        | 3 150                                       | 185        | 9 250                                       |
| 75         | 387                                         | 112        | 1 120                                       | 149        | 3 250                                       | 186        | 9 500                                       |
| 76         | 400                                         | 113        | 1 150                                       | 150        | 3 350                                       | 187        | 9 750                                       |
| 77         | 412                                         | 114        | 1 180                                       | 151        | 3 450                                       | 188        | 10 000                                      |
| 78         | 425                                         | 115        | 1 215                                       | 152        | 3 550                                       | 189        | 10 300                                      |
| 79         | 437                                         | 116        | 1 250                                       | 153        | 3 650                                       | 190        | 10 600                                      |
| 80         | 450                                         | 117        | 1 285                                       | 154        | 3 750                                       | 191        | 10 900                                      |
| 81         | 462                                         | 118        | 1 320                                       | 155        | 3 875                                       | 192        | 11 200                                      |
| 82         | 475                                         | 119        | 1 360                                       | 156        | 4 000                                       | 193        | 11 500                                      |
| 83         | 487                                         | 120        | 1 400                                       | 157        | 4 125                                       | 194        | 11 800                                      |
| 84         | 500                                         | 121        | 1 450                                       | 158        | 4 250                                       | 195        | 12 150                                      |
| 85         | 515                                         | 122        | 1 500                                       | 159        | 4 375                                       | 196        | 12 500                                      |
| 86         | 530                                         | 123        | 1 550                                       | 160        | 4 500                                       | 197        | 12 850                                      |
| 87         | 545                                         | 124        | 1 600                                       | 161        | 4 625                                       | 198        | 13 200                                      |
| 88         | 560                                         | 125        | 1 650                                       | 162        | 4 750                                       | 199        | 13 600                                      |
| 89         | 580                                         | 126        | 1 700                                       | 163        | 4 875                                       | 200        | 14 000                                      |
| 90         | 600                                         | 127        | 1 750                                       | 164        | 5 000                                       |            |                                             |
| 91         | 615                                         | 128        | 1 800                                       | 165        | 5 150                                       |            |                                             |
| 92         | 630                                         | 129        | 1 850                                       | 166        | 5 300                                       |            |                                             |
| 93         | 650                                         | 130        | 1 900                                       | 167        | 5 450                                       |            |                                             |
| 94         | 670                                         | 131        | 1 950                                       | 168        | 5 600                                       |            |                                             |
| 95         | 690                                         | 132        | 2 000                                       | 169        | 5 800                                       |            |                                             |
| 96         | 710                                         | 133        | 2 060                                       | 170        | 6 000                                       |            |                                             |

**Table 2 Speed Category Symbol and Maximum Speed**  
(Clause 3.33.2)

| Sl No. | Speed Category Symbol | Maximum Speed<br>(km/h) |
|--------|-----------------------|-------------------------|
| (1)    | (2)                   | (3)                     |
| i)     | F                     | 80                      |
| ii)    | G                     | 90                      |
| iii)   | J                     | 100                     |
| iv)    | K                     | 110                     |
| v)     | L                     | 120                     |
| vi)    | M                     | 130                     |
| vii)   | N                     | 140                     |
| viii)  | P                     | 150                     |
| ix)    | Q                     | 160                     |
| x)     | R                     | 170                     |
| xi)    | S                     | 180                     |
| xii)   | T                     | 190                     |
| xiii)  | U                     | 200                     |
| xiv)   | H                     | 210                     |

used tyre by replacing the worn tread with new material. It may also include renovation of the outermost sidewall surface and replacement of the crown plies or the protective breaker. It covers the following process methods:

- Top-capping* — Replacement of the tread.
- Re-capping* — Replacement of the tread and with the new material extending over part of the sidewall.
- Bead-to-bead* — Replacement of the tread and renovation of the sidewall including all or part of the lower area of the tyre.

**3.37 Casing** — Worn tyre comprising carcass and remaining tread and sidewall material.

**3.38 Buffing** — Process of removing old material from the casing to prepare the surface for the new material.

**3.39 Repair** — Remedial work carried out to damaged casings within recognized limits.

**3.40 Tread Material** — Material in a condition suitable for replacing the worn tread. It may be in several forms, for example:

- Camel-Back* — Pre-cut lengths of material which have been extruded to give the required cross-section profile and subsequently fitted cold to the prepared casing. The new material shall be cured.
- Strip-Wound* — Ribbon of tread material which is directly extruded and wound on to the prepared casing and build up to the required cross-sectional

contour. The new material shall be cured.

- Direct Extrusion* — The tread material extruded to give the required cross-sectional profile and directly extruded on the prepared casing. The new material shall be cured.

- Pre-cured* — The previously formed and cured tread applied directly to the prepared casing. The new material shall be bonded to the casing.

**3.41 Sidewall Veneer** — The material used to cover the sidewalls of the casing thereby allowing the required markings to be formed.

**3.42 Cushion Gum** — The material used as a bonding layer between new tread and casing and for repairing minor damage.

**3.43 Cement** — An adhesive solution to hold new materials in place prior to the curing process.

**3.44 Cure** — The terms used to describe the change in physical properties of the new material which is brought about usually by the application of heat and pressure for a set period of time under controlled conditions.

## 4 REQUIREMENTS

### 4.1 Conditions Before Retreading

**4.1.1** Tyres shall be clean and dry before inspection.

**4.1.2** Before buffing, each tyre shall be thoroughly

**Table 3 Variation of Load Capacity with Speed — Commercial Vehicle Tyres —**  
**Radial and Diagonal Ply**  
*(Clause 3.35)*

| Sl No. | Speed<br>km/h | Variation of Load Capacity, Percent |          |          |          |                               |          |                               |           |           |                   |
|--------|---------------|-------------------------------------|----------|----------|----------|-------------------------------|----------|-------------------------------|-----------|-----------|-------------------|
|        |               | All Load Indices                    |          |          |          | Load Indices $\geq 122^{(1)}$ |          | Load Indices $\leq 121^{(1)}$ |           |           |                   |
|        |               | Speed category symbol               |          |          |          | Speed category symbol         |          | Speed category symbol         |           |           |                   |
|        |               | (3)<br>F                            | (4)<br>G | (5)<br>J | (6)<br>K | (7)<br>L                      | (8)<br>M | (9)<br>L                      | (10)<br>M | (11)<br>N | (12)<br>$P^{(2)}$ |
| i)     | 0             | +150                                | +150     | +150     | +150     | +150                          | +150     | +110                          | +110      | +110      | +110              |
| ii)    | 5             | +110                                | +110     | +110     | +110     | +110                          | +110     | +90                           | +90       | +90       | +90               |
| iii)   | 10            | +80                                 | +80      | +80      | +80      | +80                           | +80      | +75                           | +75       | +75       | +75               |
| iv)    | 15            | +65                                 | +65      | +65      | +65      | +65                           | +65      | +60                           | +60       | +60       | +60               |
| v)     | 20            | +50                                 | +50      | +50      | +50      | +50                           | +50      | +50                           | +50       | +50       | +50               |
| vi)    | 25            | +35                                 | +35      | +35      | +35      | +35                           | +35      | +42                           | +42       | +42       | +42               |
| vii)   | 30            | +25                                 | +25      | +25      | +25      | +25                           | +25      | +35                           | +35       | +35       | +35               |
| viii)  | 35            | +19                                 | +19      | +19      | +19      | +19                           | +19      | +29                           | +29       | +29       | +29               |
| ix)    | 40            | +15                                 | +15      | +15      | +15      | +15                           | +15      | +25                           | +25       | +25       | +25               |
| x)     | 45            | +13                                 | +13      | +13      | +13      | +13                           | +13      | +22                           | +22       | +22       | +22               |
| xi)    | 50            | +12                                 | +12      | +12      | +12      | +12                           | +12      | +20                           | +20       | +20       | +20               |
| xii)   | 55            | +11                                 | +11      | +11      | +11      | +11                           | +11      | +17.5                         | +17.5     | +17.5     | +17.5             |
| xiii)  | 60            | +10                                 | +10      | +10      | +10      | +10                           | +10      | +15.0                         | +15.0     | +15.0     | +15.0             |
| xiv)   | 65            | +7.5                                | +8.5     | +8.5     | +8.5     | +8.5                          | +8.5     | +13.5                         | +13.5     | +13.5     | +13.5             |
| xv)    | 70            | +5.0                                | +7.0     | +7.0     | +7.0     | +7.0                          | +7.0     | +12.5                         | +12.5     | +12.5     | +12.5             |
| xvi)   | 75            | +2.5                                | +5.5     | +5.5     | +5.5     | +5.5                          | +5.5     | +11.0                         | +11.0     | +11.0     | +11.0             |
| xvii)  | 80            | 0                                   | +4.0     | +4.0     | +4.0     | +4.0                          | +4.0     | +10.0                         | +10.0     | +10.0     | +10.0             |
| xviii) | 85            |                                     | +2.0     | +3.0     | +3.0     | +3.0                          | +3.0     | +8.5                          | +8.5      | +8.5      | +8.5              |
| xix)   | 90            |                                     | 0        | +2.0     | +2.0     | +2.0                          | +2.0     | +7.5                          | +7.5      | +7.5      | +7.5              |
| xx)    | 95            |                                     |          | +1.0     | +1.0     | +1.0                          | +1.0     | +6.5                          | +6.5      | +6.5      | +6.5              |
| xxi)   | 100           |                                     |          | 0        | 0        | 0                             | 0        | +5.0                          | +5.0      | +5.0      | +5.0              |

**Table 3 (Concluded)**

| SI No.  | Speed<br>km/h | Variation of Load Capacity, Percent |          |          |          |                              |          |                              |           |           |                         |
|---------|---------------|-------------------------------------|----------|----------|----------|------------------------------|----------|------------------------------|-----------|-----------|-------------------------|
|         |               | All Load Indices                    |          |          |          | Load Indices $\geq 122^{1)}$ |          | Load Indices $\leq 121^{1)}$ |           |           |                         |
|         |               | Speed category symbol               |          |          |          | Speed category symbol        |          | Speed category symbol        |           |           |                         |
|         |               | (3)<br>F                            | (4)<br>G | (5)<br>J | (6)<br>K | (7)<br>L                     | (8)<br>M | (9)<br>L                     | (10)<br>M | (11)<br>N | (12)<br>P <sup>2)</sup> |
| xxii)   | 105           |                                     |          |          | 0        | 0                            | 0        | +3.75                        | +3.75     | +3.75     | +3.75                   |
| xxiii)  | 110           |                                     |          |          | 0        | 0                            | 0        | +2.5                         | +2.5      | +2.5      | +2.5                    |
| xxiv)   | 115           |                                     |          |          |          | 0                            | 0        | +1.25                        | +1.25     | +1.25     | +1.25                   |
| xxv)    | 120           |                                     |          |          |          | 0                            | 0        | 0                            | 0         | 0         | 0                       |
| xxvi)   | 125           |                                     |          |          |          |                              | 0        |                              | 0         | 0         | 0                       |
| xxvii)  | 130           |                                     |          |          |          |                              | 0        |                              | 0         | 0         | 0                       |
| xxviii) | 135           |                                     |          |          |          |                              |          |                              |           | 0         | 0                       |
| xxix)   | 140           |                                     |          |          |          |                              |          |                              |           | 0         | 0                       |
| xxx)    | 145           |                                     |          |          |          |                              |          |                              |           |           | 0                       |
| xxxi)   | 150           |                                     |          |          |          |                              |          |                              |           |           | 0                       |

<sup>1)</sup> Load indices refer to a single operation.

<sup>2)</sup> Load variations are not allowed for speeds above 160 km/h. For speed category symbols 'Q' and above the speed category corresponding to the speed category symbol (see 3.33) specifies the maximum speed permitted for the tyre.

examined both internally and externally to ensure its suitability for retreading.

**4.1.3** Tyres where damage is visible, which has resulted from overload or under inflation shall not be retreaded.

**4.1.4** Tyres showing any of the following damage shall not be accepted for retreading:

**4.1.4.1 General**

- a) Non-repairable rubber cracking extending through to the carcass,
- b) Carcass break up,
- c) Appreciable oil or chemical attack, and
- d) Damaged or broken bead core.

**4.1.4.2 Conditions outside specified limits of repairability**

- a) Carcass penetrations or damage after preparation for repair,
- b) Multiple damage too close together,
- c) Substantial deterioration of inner lining,
- d) Bead damage,
- e) Exposed carcass cords,
- f) Loose cords,
- g) Belt ply separation,
- h) Permanently deformed or kinked (steel) carcass cords,
- j) Circumferential cracking above the bead,
- k) Corroded steel cord or bead wire, and
- m) Deterioration due to weathering effect.

**4.2 Preparation**

**4.2.1** After buffing, and before the application of new material, each tyre shall be thoroughly re-examined to ensure its continued suitability for retreading.

**4.2.2** The entire surface to which new material is to be applied shall have been prepared without overheating. The buffed surface texture shall not contain deep buffing lacerations or loose material.

**4.2.3** Where precured material is to be used the contours of the prepared area shall meet the requirements of the material manufacturer.

**4.2.4** Damage caused during buffing shall not exceed defined limits of repair.

**4.2.5** Buffing damage to diagonal ply tyres shall not extend beyond the outermost carcass ply in the crown area. It shall be assumed that the first ply encountered is a carcass

ply unless a breaker can be positively identified. If a breaker is fitted, localized damage is permissible.

**4.2.6** Localized buffing damage to the belt of radial tyres is permissible. For larger damage it is permissible for the complete belt or sections of the belt to be replaced. Where a protective breaker is fitted, and can be positively identified as such, if it is damaged it is permissible to remove it and it need not be renewed.

**4.2.7** Exposed steel parts shall be treated as soon as possible with appropriate material as defined by the manufacturer of that appropriate material.

**4.3 Retreading**

**4.3.1** The retreader shall ensure that either the manufacturer or the supplier of repair materials, including patches, is responsible for the following:

- a) Defining method(s) of application and storage, if requested by the retreader, in the local language of the state in which the materials are to be used,
- b) Defining limits of damage for which the materials are designed, if requested by the retreader, in the local language of the state in which the materials are to be used,
- c) Ensuring that reinforced patches for tyres, if correctly applied in carcass repairs, are suitable for the purpose,
- d) Ensuring that patches are capable of withstanding twice the maximum inflation pressure as given by the tyre manufacturer, and
- e) Ensuring the suitability of any other repair materials for the service intended.

**4.3.2** The retreader shall be responsible for the correct application of the repair material and for ensuring that the repair is free from any defects, which may affect the satisfactory service life of the tyre.

**4.3.3** The area surrounding a reinforced repair to a sidewall or shoulder of a radial ply tyre may bulge slightly when the tyre is fitted and inflated to the recommended operating pressure. Reinforced repair materials with physical properties that restrict the height of the bulge not more than 4 mm shall be used.

**4.3.4** The retreader shall ensure that either the manufacturer or the supplier of tread and sidewall material issues specifications concerning the conditions of storage and use of the material in order to guarantee the material's qualities. If requested by the retreader, this information shall be in the local language of the state in which the materials are to be used.

**4.3.5** The retreader must ensure that the repair material and/or compound are documented in a manufacturer's or supplier's certificate. The material compound shall be as per the details/specification of retreading material specifications/retreader. Bonding gum, cushion gum, vulcanizing solution and tread-rubber used for tyre retreading shall be compatible and preferable of the same make.

**4.3.6** The processed tyre shall be cured as soon as possible after the completion of all repairs and building-up operations and at the latest according to the material manufacturer's specifications.

**4.3.7** The tyre shall be cured for the length of time and at the temperature and pressure, appropriate to, and specified for the materials and processing equipment used. The dimensions of the mould shall be appropriate to the thickness of the new material and the size of the buffed tyre.

**4.3.8** The thickness of original material after buffing and the average thickness of any new material under the tread pattern, after retreading shall be:

**4.3.8.1** For radial ply tyres (in mm) (see Fig. 2):

$$3 \leq (A + B) \leq 13 \quad (\text{Min } 3.0 \text{ mm; Max } 13.0 \text{ mm})$$

$$A \geq 2 \quad (\text{Min } 2.0 \text{ mm})$$

$$B \geq 0 \quad (\text{Min } 0.0 \text{ mm})$$

**4.3.8.2** For diagonal (bias-ply) tyres:

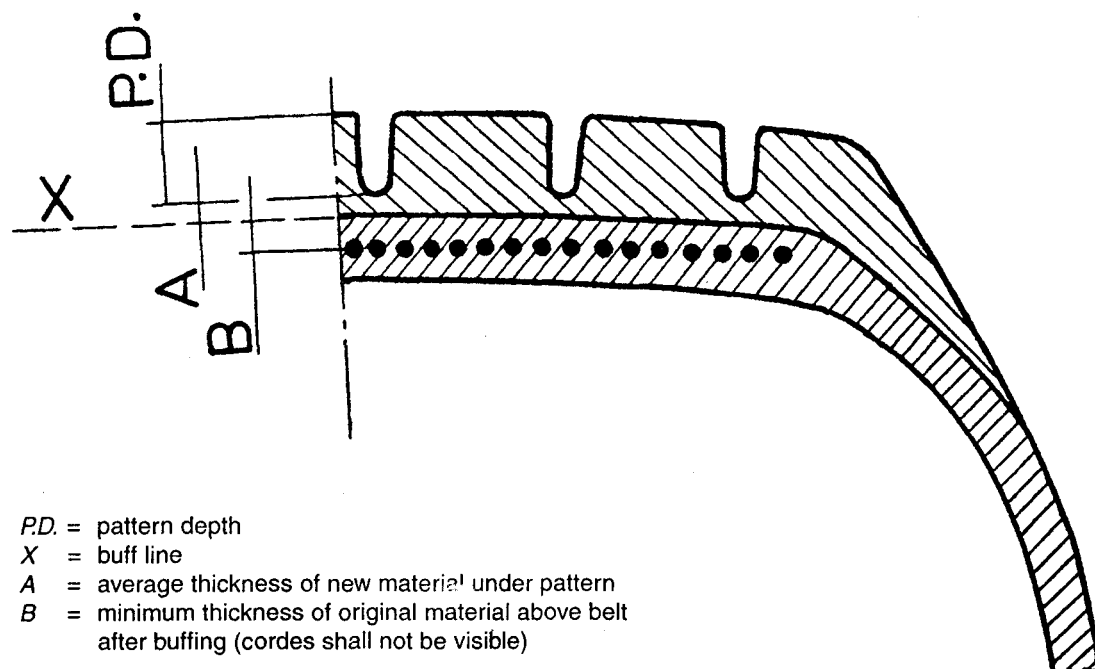
- a) Thickness of original material above the breaker shall be  $\geq 0.80$  mm.
- b) Average thickness of new material above the buffed casing line shall be  $\geq 2.00$  mm.
- c) Combined thickness of original and new material beneath the base of the grooves of the tread pattern shall be  $\geq 3.00$  and  $\leq 13.00$  mm.

**4.3.9** The service description of a retreaded tyre shall not show either a higher speed symbol or a higher load index than that of the original first life.

**4.3.10** Upgrading of the service description given in 4.3.9 shall only be permitted for the first retread of an original, first life tyre. Tyres, which have been previously retreaded, shall not have either the speed symbol or the load index raised above that shown on the used casing.

**4.3.11** Tread wear indicators shall be incorporated as follows:

- a) The retreaded pneumatic tyre shall include not less than six transverse rows of tread wear indicators, approximately equispaced and situated in the principal grooves of the tread. The tread wear indicators shall be such that it cannot be confused with the material ridges between the ribs or blocks of the tread.
- b) However, in the case of tyres designed for mounting on rims of a nominal diameter of code 12 or less, four rows of tread wear indicators are permissible.
- c) The tread wear indicators shall provide a means of indicating, with a tolerance of  $^{+0.60}_{-0.60}$  mm when the tread grooves are no longer more than 1.6 mm deep.



- P.D. = pattern depth  
 X = buff line  
 A = average thickness of new material under pattern  
 B = minimum thickness of original material above belt after buffing (cordes shall not be visible)

FIG. 2 BUFF LINE OF TYRE

- d) The height of the tread wear indicators shall be determined by measuring the difference between the depth from the tread surface to the top of the tread wear indicators and the base of the tread grooves, close to the slope at the base of tread wear indicators.

4.4 Inspection

4.4.1 After curing, whilst a degree of heat is retained in a tyre, each retreaded tyre shall be examined to ensure that it is free from any apparent defects. During or after retreading the tyre must be inflated to at least 1.5 bar for examination. Where there is any apparent defect in the profile of the tyre (for example, blister, depression, etc), the tyre shall be specifically examined to determine the cause of the defect.

4.4.2 Before, during or after retreading, the tyre shall be checked at least once, for the integrity of its structure, by means of a suitable inspection method.

4.4.3 For the purposes of quality control, a number of retreaded tyres shall be subjected to destructive and/or non-destructive testing or examination. The quantity of tyres checked and the results shall be recorded.

4.4.4 After retreading, the dimensions of the retreaded tyre, when measured in accordance with Annex A, shall conform either to dimensions calculated according to the procedure given in 5 or to those given in Annex C of IS 15636. Note that the maximum outer diameter of a retreaded tyre may be up to 1.5 percent greater than the maximum outer diameter of a new original tyre.

4.4.5 Tread wear indicators shall conform to the requirements of 4.3.11.

5 TYRE DIMENSIONS

5.1 The tyres dimensions shall be measured as per the method given in Annex A.

5.1.1 Section Width

5.1.1.1 The section width shall be calculated by using the following formula:

$$S = S_1 + K (A - A_1)$$

where

$S$  = actual section width as measured on the test rim, in mm;

$S_1$  = value of the design section width, referred to the measuring rim, as quoted in the International Tyre Standard specified by the retreader for the tyre size in question;

$A$  = width of the test rim, in mm;

$A_1$  = width in of the measuring rim as quoted in the International Tyre Standard specified by the retreader for the tyre size in question, in mm; and

$K$  = factor shall be taken as 0.4.

5.1.1.2 The actual overall width may be less than the section width or widths determined in 5.1. The actual overall width may also exceed the value or values determined in 5.1 by:

- a) 4 percent in the case of radial ply tyres; and
- b) 8 percent in the case of diagonal (bias-ply) or bias-belted tyres; and in addition, if the tyres have a special protective band, the width may be greater by up to 8 mm above the tolerances given in (a) and (b).

5.1.2 Outer Diameter

5.1.2.1 The theoretical outer diameter of a retreaded tyre shall be calculated by using the following formula:

$$D = d + 2H$$

where

$D$  = theoretical outer diameter, in mm;

$d$  = conventional number specified in 3.21(c), in mm;

$H$  = nominal section height, in mm =  $S'_n \times 0.01 R_a$ ;

$S'_n$  = nominal section width, in mm; and

$R_a$  = nominal aspect ratio.

All of the above symbols are as quoted in the tyre size designation as shown on the sidewall of the tyre and shall conform to the requirements given in 3.21.

5.1.2.2 The actual outer diameter of a retreaded tyre shall not be outside the minimum and maximum diameter obtained by the following formula:

$$D_{Min} = d + (2H \times a)$$

$$D_{Max} = 1.015 \times [d + (2H + b)]$$

where

a) coefficient 'a' = 0.97

b) coefficient 'b', for normal use tyres is:

| Radial tyres | Diagonal (Bias-ply) and Bias-Belted Tyres |
|--------------|-------------------------------------------|
| 1.04         | 1.08                                      |

c) for snow tyres the maximum outer diameter ( $D_{Max}$ ) calculated in 5.1.2.2 may be exceeded by not more than 1 percent.

5.1.2.3 However, for tyres whose designation is given in col 2 of Tables 4 to 12 in IS 15636, the outer diameter shall be that given in those tables.

## 6 ENDURANCE TEST

**6.1** Each type of pneumatic tyre shall undergo at least one endurance test. The sample shall conform to the requirements specified in **6.1.1** and **6.1.2** when tested as per the method given in Annex B.

**6.1.1** A tyre which, after undergoing the endurance test, shall not exhibit any tread separation, ply separation, cord separation, chunking or broken cords.

**6.1.2** The outer diameter of the tyre, measured six hours after the endurance test, shall not differ by more than  $\pm 3.5$  percent from the outer diameter as measured before the test.

## 7 LOAD/SPEED PERFORMANCE TEST

**7.1** Each type of pneumatic tyre having:

- a) Load index (maximum load rating) 122 or more, and
- b) Load index (maximum load rating) 121 or less and a speed category 150 km/h and below shall undergo load/speed tests. The sample shall conform to the requirements specified in **7.1.1**, when tested as per the method given in Annex C.

**7.1.1** A tyre which, after undergoing the load/speed test, shall not exhibit any tread separation, ply separation, cord separation, chunking or broken cords.

## 8 TYRE STRENGTH TEST

**8.1** The tyre strength test (plunger test) shall be carried out in accordance with the method given in Annex D and the sample shall conform to the requirements given in Tables 5, 6 and 7.

**8.1.1** Tyre strength of light truck and truck and bus tyres (for which the load index is shown) shall conform to the requirements given in Tables 5 and 6.

**8.1.2** Nylon tyre shall conform to the requirements given in Table 7.

## 9 MARKINGS

**9.1** An example of the arrangement of retreaded tyre markings is given in Annex E.

**9.2** Retreaded tyres shall display on both sidewalls in the case of symmetrical tyres and at least on the outer sidewall in the case of asymmetrical tyres.

**9.2.1** The brand name or trade-mark.

**9.2.2** The tyre size designation given in **3.2.1**.

**9.2.3** An indication of the structure as follows:

- a) On diagonal (bias-ply) tyres, no indication or the letter 'D' placed in front of the rim-diameter marking.
- b) On radial-ply tyres; the letter 'R' placed in front of the rim-diameter marking and optionally the word 'RADIAL'.
- c) On bias-belted tyres, the letter 'B' placed in front of the rim-diameter marking and in addition the word 'BIAS-BELTED'.

**9.2.4** The service description comprising:

- a) An indication of the tyre's nominal load capacity/capacities in the form of the load index/indices given in **3.32**, and
- b) An indication of the tyre's nominal speed capability in the form of the symbol given in **3.33**.

**9.2.5** If applicable, one alternative service description, the unique point, comprising:

**9.2.5.1** An indication of the tyre's nominal load capacity/capacities in the form of the load index or maximum load /indices given in **3.32**.

**9.2.5.2** An indication of the tyre's nominal speed capability in the form of the symbol given in **3.33**.

**9.2.6** The word 'TUBELESS' if the tyre is designed for use without an inner tube.

**9.2.7** The inscription M+S or MS or M.S. or M&S in the case of snow tyre.

**9.2.8** The date of retreading as follows:

In the form of month and year code in which the tyre was retreaded. For example, the marking MAR 04 could indicate a tyre which was retreaded in the month of March of the year 2004. (OR) In the form of a group of four digits, the first two showing the week number and the second two showing the year in which the tyre was retreaded. The date code can cover a period of production from the week indicated by the week number up to and including the week number plus three. For example, the marking '2504' could indicate a tyre which was retreaded in weeks 25 of the year 2004.

This date code may be marked on one sidewall only.

**9.2.9** In the case of tyres which can be regrooved, the symbol 'U' in a circle at least 20 mm diameter, or the word 'REGROOVABLE', moulded into or on to each sidewall.

**9.2.10** An indication by means of the kPa or bar or kg/cm<sup>2</sup> or any combination of this units of the inflation

pressure to be adopted for the load/speed endurance tests. This indication may be placed on one sidewall only.

**9.2.11** The term 'RETREAD' at the request of retreader, the same term in other languages may also be added.

**9.3** The markings shall be clearly legible and mould on to or into the tyre or shall be permanently marked on to the tyre.

**9.4** As far as any of the original manufacturer's specifications are still legible after the tyres have been retreaded, they shall be regarded as specifications of the retreader for the retreaded tyre. If these original specifications do not apply after retreading they shall be completely removed.

**9.5** The number of times tyre retreaded shall be marked on the tyre.

## 10 CRITERION FOR CONFORMITY

For the purpose of ascertaining conformity of the tyres to this standard, the scale of sampling and criterion for conformity to the test requirements shall be mutually agreed to between the manufacturer and the purchaser.

## 11 BIS CERTIFICATION MARKING

The product may also be marked with the Standard Mark.

**11.1** The use of the Standard Mark is governed by the provisions of the *Bureau of Indian Standards Act, 1986* and the Rules and Regulations made thereunder. The details of conditions under which the licence for the use of the Standard Mark may be granted to manufacturers or producers may be obtained from the Bureau of Indian Standards.

## ANNEX A

(Clauses 4.4.4 and 5.1)

### METHOD OF MEASURING PNEUMATIC TYRES

**A-1** The tyre shall be mounted on the test rim specified by the retreader and inflated to the nominal inflation pressure in relation to the maximum load carrying capacity for that size and load index.

**A-2** The tyre fitted to the appropriate rim, shall be conditioned to the ambient temperature of the laboratory for at least 24 h.

**A-3** The pressure shall be readjusted to the value given in A-1.

**A-4** The overall width shall be measured at six equally spaced points around the tyre, taking account of the thickness of any protective ribs or bands. The highest measurement obtained shall be taken as the overall width.

**A-5** The outer diameter shall be calculated for a measurement of the maximum circumference of the inflated tyre.

**A-6** Determine the outer diameter by measuring the maximum circumference and dividing the figure so obtained by  $\pi$  (3.1416). The tyre overall diameter shall be calculated by using the following formula:

$$D = \frac{C}{\pi}$$

where

$D$  = tyre overall diameter, in mm; and

$C$  = circumference of tyre tread, in mm.

## ANNEX B

### (Clause 6.1)

#### PROCEDURE FOR ENDURANCE TEST

##### B-1 PREPARING THE TYRE FOR TEST

**B-1.1** Mount a retreaded tyre on the test rim specified by the retreader.

**B-1.2** Use a new inner tube or combination of inner tube, valve and flap (as required) when testing tyres with inner tubes.

**B-1.3** Inflate the tyre to the appropriate pressure corresponding to the pressure index as specified.

**B-1.4** Condition the tyre and wheel assembly at test-room temperature for not less than 3 h.

**B-1.5** Readjust the tyre pressure to that specified in **B-1.3**.

##### B-2 TEST PROCEDURE

**B-2.1** Mount the tyre and wheel assembly on a test axle and press it against the outer face of a smooth surfaced power driven test drum either 1.70 m  $\pm$  1 percent diameter having a surface at least as wide as the tyre tread. In certain cases a 2.00 m  $\pm$  1 percent diameter drum may be used.

**B-2.2** Apply to the test axle a series of test loads equal to a percentage of the load indicated in Tables 1 and 2, corresponding to the load index indicated on the tyre, and in accordance with the test programme below. Where the tyre has load capacity indices for operation in both single and twin or dual formation the load corresponding to the load index for single operation shall be used for the test.

**B-2.2.1** In the case of a tyre with a load index  $\leq 121$  and a speed symbol  $\geq Q$  (160 km/h), the test procedure shall be as specified in **B-3**.

**B-2.2.2** For all other tyres the test procedure is as shown in Table 4.

##### B-2.3 Endurance Test Programme

**B-2.3.1** The tyre pressure shall not be corrected throughout

the test and the test load shall be kept constant throughout each of the three test stages.

**B-2.3.2** During the test the temperature in the test-room must be maintained at between 20°C and 40°C unless the tyre manufacturer or retreader agrees to the use of a higher temperature.

**B-2.4** The endurance test programme shall be carried out without interruption.

##### B-3 LOAD/SPEED TEST PROCEDURE FOR TYRES WITH A LOAD INDEX $\leq 121$ AND A SPEED SYMBOL $\geq Q$ (160 km/h)

**B-3.1** The load on the wheel and tyre shall be the following percentage of that corresponding to the load index of the tyre:

- a) 90 percent when tested on a drum of 1.70 m  $\pm$  1 percent diameter; and
- b) 92 percent when tested on a drum of 2.00 m  $\pm$  1 percent diameter.

**B-3.2** The initial phase test speed shall be 20 km/h less than that indicated by the speed symbol for the tyre:

- a) Time to reach initial test speed for 10 min.
- b) The duration of the first phase for 10 min.

**B-3.3** The second phase test speed shall be 10 km/h less than that indicated by the speed symbol for the tyre.

**B-3.3.1** The duration of the second phase for 10 min.

**B-3.4** The final phase test speed shall be the speed corresponding to that indicated by the speed symbol for the tyre.

The duration of the final phase for 30 min.

**B-3.5** The duration of the entire test for 1 h.

**Table 4 Endurance Test Programme**  
(Clause B-2.2.2)

| Sl No. | Load Index  | Speed Symbol | Test Drum Speed |                                          | Load Placed on the Wheel as a Percentage of the Load Corresponding to the Load Index |                  |                    |
|--------|-------------|--------------|-----------------|------------------------------------------|--------------------------------------------------------------------------------------|------------------|--------------------|
|        |             |              | Radial Ply rpm  | Diagonal (Bias-Ply) and Bias-Belted, rpm | 7 h                                                                                  | 16 h             | 24 h               |
| (1)    | (2)         | (3)          | (4)             | (5)                                      | (6)                                                                                  | (7)              | (8)                |
| i)     | 122 or more | F            | 100             | 100                                      | 66 percent                                                                           | 84 percent       | 101 percent        |
|        |             | G            | 125             | 100                                      |                                                                                      |                  |                    |
|        |             | J            | 150             | 125                                      |                                                                                      |                  |                    |
|        |             | K            | 175             | 150                                      |                                                                                      |                  |                    |
|        |             | L            | 200             | —                                        |                                                                                      |                  |                    |
|        |             | M            | 225             | —                                        |                                                                                      |                  |                    |
| ii)    | 121 or less | F            | 100             | 100                                      | 70 percent<br>4h                                                                     | 88 percent<br>6h | 106 percent<br>24h |
|        |             | G            | 125             | 125                                      |                                                                                      |                  |                    |
|        |             | J            | 150             | 150                                      |                                                                                      |                  |                    |
|        |             | K            | 175             | 175                                      |                                                                                      |                  |                    |
|        |             | L            | 200             | 175                                      | 75 percent                                                                           | 97 percent       | 114 percent        |
|        |             | M            | 250             | 200                                      | 75 percent                                                                           | 97 percent       | 114 percent        |
|        |             | N            | 275             | —                                        | 75 percent                                                                           | 97 percent       | 114 percent        |
|        |             | P            | 300             | —                                        | 75 percent                                                                           | 97 percent       | 114 percent        |

## NOTES

1 'Special-use' tyres should be tested at a speed equal to 85 percent of the speed prescribed for equivalent normal tyres.

2 Tyres with load index 121 or more, speed categories N or P and the additional marking 'LT' included in the tyre size designation shall be tested with the same programme as specified in the above table for tyres with load index 121 or less.

## ANNEX C

(Clause 7.1)

### PROCEDURE FOR LOAD/SPEED PERFORMANCE TEST

#### C-1 PREPARING THE TYRE FOR TEST

**C-1.1** Mount a retreaded tyre on the test rim specified by the retreader.

**C-1.2** Use a new inner tube or combination of inner tube, valve and flap (as required) when testing tyres with inner tubes.

**C-1.3** Inflate the tyre to the pressure corresponding to the pressure specified by the manufacturer.

**C-1.4** Condition the tyre-and-wheel assembly at test-room

temperature for not less than 3 h.

**C-1.5** Readjust the tyre pressure to that specified in C-1.3.

#### C-2 TEST PROCEDURE

**C-2.1** Load placed on the wheel as a percentage of the load corresponding to the load index.

**C-2.2** Ninety percent when tested on a test drum, 1.70 m ± 1 percent in diameter.

**C-2.3** Ninety-two percent when tested on a test drum, 2.0 m  $\pm$  1 percent in diameter.

#### **C-2.4 Initial Test Speed**

Speed corresponding to the speed category symbol less 20km/h:

- a) Time to reach the initial test speed for 10 min; and
- b) Duration of the first step for 10 min.

#### **C-2.5 Second Test Speed**

Speed corresponding to the speed category symbols less by 10 km/h. Duration of the second step for 20 min.

#### **C-2.6 Final Test Speed**

Speed corresponding to the speed category symbol (Reference speed).

- a) Duration of the final step for 20 min.
- b) Total test duration for 1h.

## **ANNEX D**

(Clause 8.1)

### **TYRE STRENGTH TEST (PLUNGER TEST)**

#### **D-1 APPARATUS**

The equipment consists of a cylindrical steel plunger, having a hemispherical end of a diameter specified in 8 and Table 6 as applicable for type of tyre and a device to force the plunger rod into a tyre at the rate of 50  $\pm$  1.5 mm/min.

##### **D-1.1 Preparation of Tyre for the Test**

The tyre with a tube shall be mounted and inflated on a test rim of the recommended size and shall be conditioned at approximately the temperature of the room in which the test is to be conducted for at least 3 h after which the pressure shall be adjusted, if necessary, to the test inflation pressure.

##### **D-1.2 Test Procedure**

The plunger rod shall be forced into the tread of the tyre/wheel assembly mounted as specified in D-1.1 perpendicularly over a tread element at the centreline of the tread, or as near as possible to avoid penetration into a tread groove. The rate of travel of the plunger; shall be 50  $\pm$  1.5 mm/min until the tyre breaks or the plunger is stopped by the rim (bottoming of the plunger against the

rim), in which case the tyre shall be deemed to have passed the test regardless of energy value. Measurement of force and penetration at break (or bottoming against the rim) shall be made at 5 points nearly equally spaced around the tyre circumference. The arithmetic mean energy absorbed shall be calculated from the five energy values obtained at the break, by using the formula given in D-1.2.1.

##### **D-1.2.1 Formula for calculating the breaking energy:**

$$W = \frac{F \times P}{2} \times 10^{-3}$$

where

$W$  = energy at break (or bottoming), in J (Joule);

$F$  = force at break (or bottoming), in N; and

$P$  = penetration at break (or bottoming), in mm.

**D-1.3** As an option, for purpose of conformity, if the plunger energy measurements meet or exceed the minimum value specified, it is not necessary to continue penetration of the plunger to break the tyre.

**Table 5 Tyre Strength — Light Truck, Truck and Bus Tyres**  
**(For Which the Load Index is Shown)**  
*(Clause 8.1)*

| Sl No. | Air Pressure<br>Corresponding to the<br>Maximum Load<br>Capability<br>kPa | Load Index (Single Wheel) 121 Maximum               |                                                       | Load Index<br>(Single Wheel)<br>122 or More<br>kgf.cm (Joules) |
|--------|---------------------------------------------------------------------------|-----------------------------------------------------|-------------------------------------------------------|----------------------------------------------------------------|
|        |                                                                           | Nominal Rim<br>Diameter Under 13<br>kgf.cm (Joules) | Nominal Rim<br>Diameter 13 or More<br>kgf.cm (Joules) |                                                                |
| (1)    | (2)                                                                       | (3)                                                 | (4)                                                   | (5)                                                            |
| i)     | 250 or less                                                               | 1 385 (136)                                         | 3 000 (294)                                           | —                                                              |
| ii)    | 251 to 350                                                                | 2 072 (203)                                         | 3 690 (362)                                           | —                                                              |
| iii)   | 351 to 450                                                                | 2 765 (271)                                         | 5 240 (514)                                           | —                                                              |
| iv)    | 451 to 550                                                                | —                                                   | 5 875 (576)                                           | 9 910 (972)                                                    |
| v)     | 551 to 650                                                                | —                                                   | 6 565 (644)                                           | 14 400 (1 412)                                                 |
| vi)    | 651 to 750                                                                | —                                                   | 7 260 (712)                                           | 17 285 (1 695)                                                 |
| vii)   | 751 to 850                                                                | —                                                   | —                                                     | 21 310 (2 090)                                                 |
| viii)  | 851 or more                                                               | —                                                   | —                                                     | 22 465 (2 203)                                                 |

**Table 6 Diameter of Plunger**  
**(For the Tyres of Which the Load Index is Shown)**  
*(Clauses 8.1 and D-1)*

| Sl No. | Load Index for Light Truck, Truck and Bus Tyres<br>(Single Wheel) | Diameter of Plunger<br>mm |
|--------|-------------------------------------------------------------------|---------------------------|
| (1)    | (2)                                                               | (3)                       |
| i)     | 121 or less                                                       | 19 ± 0.2                  |
| ii)    | 122 or 134                                                        | 32 ± 0.3                  |
| iii)   | 135 or more                                                       | 38 ± 0.3                  |

**Table 7 Tyres Strength Test Static Breaking Energy Values**  
(Clause 8.1.2)

| <b>Tyre Range and Size Designations</b> | <b>Ply Rating</b> | <b>Plunger Diameter mm</b> | <b>Test Inflation Pressure kPa</b> | <b>Breaking Energy J, Min</b> |
|-----------------------------------------|-------------------|----------------------------|------------------------------------|-------------------------------|
| (1)                                     | (2)               | (3)                        | (4)                                | (5)                           |
| <b>Ultra Light Trucks (Nylon)</b>       |                   |                            |                                    |                               |
| 4.50-12                                 | 6                 | 19 ± 0.2                   | MSP                                | 203                           |
| 4.50-12                                 | 8                 | 19 ± 0.2                   | MSP                                | 271                           |
| <b>Light Truck (Nylon)</b>              |                   |                            |                                    |                               |
| All sizes                               | 6                 | 19 ± 0.2                   | MSP                                | 362                           |
| All sizes                               | 8                 | 19 ± 0.2                   | MSP                                | 514                           |
| All sizes                               | 10                | 19 ± 0.2                   | MSP                                | 576                           |
| All sizes                               | 12                | 19 ± 0.2                   | MSP                                | 644                           |
| All sizes                               | 14                | 19 ± 0.2                   | MSP                                | 721                           |
| All sizes                               | 16                | 19 ± 0.2                   | MSP                                | 768                           |
| <b>Truck/Bus (Nylon)</b>                |                   |                            |                                    |                               |
| All sizes                               | 10                | 32 ± 0.3                   | MSP                                | 1 412                         |
| All sizes                               | 12                | 32 ± 0.3                   | MSP                                | 1 785                         |
| All sizes                               | 14                | 38 ± 0.3                   | MSP                                | 2 282                         |
| All sizes                               | 16                | 38 ± 0.3                   | MSP                                | 2 599                         |
| All sizes                               | 18                | 38 ± 0.3                   | MSP                                | 2 825                         |
| All sizes                               | 20                | 38 ± 0.3                   | MSP                                | 3 051                         |
| All sizes                               | 22                | 38 ± 0.3                   | MSP                                | 3 220                         |
| All sizes                               | 24                | 38 ± 0.3                   | MSP                                | 3 390                         |

## NOTES

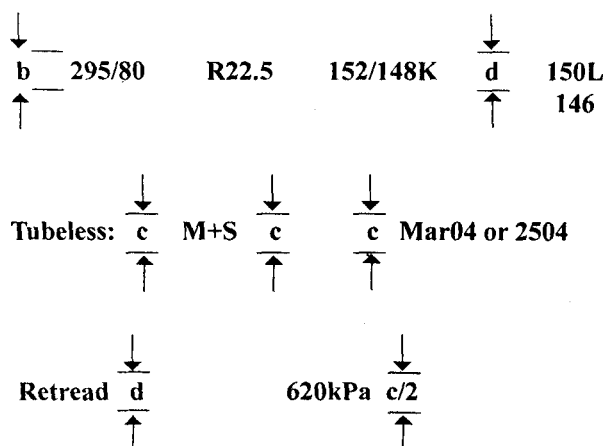
- 1 Inflate to the pressure corresponding to the maximum load, or maximum dual load where there is both single and dual load marked on the tyre.
- 2 For rayon tyres, the minimum requirement shall be 60 percent of the above values for the corresponding size and ply rating tested under identical conditions.
- 3 MSP — Maximum schedule pressure applicable to the tyre size and ply rating.

## ANNEX E

(Clause 9.1)

## ARRANGEMENT OF RETREAD TYRE MARKINGS

## E-1 EXAMPLE OF THE MARKINGS OF RETREADED TYRES



|   | Minimum Heights of Markings, mm                                                                  |                                                                                                  |
|---|--------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------|
|   | Tyres of Rim Diameter $\leq 20"$ or $\leq 508$ mm or of Section Width $\leq 235$ mm or $\leq 9"$ | Tyres of Rim Diameter $\geq 20"$ or $\geq 508$ mm or of Section Width $\geq 235$ mm or $\geq 9"$ |
| b | 6                                                                                                | 9                                                                                                |
| c |                                                                                                  | 4                                                                                                |
| d |                                                                                                  | 6                                                                                                |

## E-2 MARKINGS DEFINING A RETREADED PNEUMATIC TYRE

- Nominal section width of 295;
- Nominal aspect ratio of 80;
- Radial-ply structure (R);
- Nominal rim diameter of 572 mm, for which code is 22.5;

- Load capacities of 3 550 kg (single) and 3 150 kg (twinned or dual), corresponding respectively to the load indices 152 and 148 shown in Table 1;
- Nominal speed symbol K (reference speed 110 km/h); able to be used at the unique point, speed symbol L (reference speed 120 km/h); with a load capacity of 3 350 kg (single) and 3 000 kg (twinned or dual), corresponding respectively to the load indices 150 and 146 shown in Table 1;
- Intended to be used without an inner tube ('TUBELESS'); of snow type (M+S);
- Retreaded month and year code, that is, in March of the year 2004 or in the weeks 25 of the year 2004; and
- Requiring to be inflated to 620 kPa for load/speed endurance tests, for which the PSI symbol is 90.

## E-3 POSITIONING AND ORDER OF THE MARKINGS CONSTITUTING THE TYRE DESIGNATION

- The size designation, comprising the nominal section width, the nominal aspect ratio, the type-of-structure symbol (where applicable) and the nominal rim diameter shall be grouped as shown in the above example: 295/80 R22.5;
- The service description comprising the load index and the speed symbol shall be placed near the size designation. It may either precede the size designation or follow it or be placed above or below it;
- The symbols 'TUBELESS', 'REINFORCED', and 'M + S' may be at a distance from the size designation; and
- The word 'RETREAD' may be at a distance from the size designation symbol.

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This Indian Standard has been developed from Doc : No. TED 7 (467).

**Amendments Issued Since Publication**

| Amend No. | Date of Issue | Text Affected |
|-----------|---------------|---------------|
|           |               |               |
|           |               |               |
|           |               |               |
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